

## CLAIMS

1. A switching power source apparatus comprising:

5 a first series circuit connected to each end of a DC power source and having a primary winding of a transformer and a main switch that are connected in series;

a rectifying-smoothing circuit to rectify and smooth a voltage that is outputted from a secondary winding of the transformer when the main switch is turned on;

10 a second series circuit connected to each end of the main switch or to each end of the primary winding of the transformer and having an auxiliary switch and a clamp capacitor those are connected in series;

15 a third series circuit connected to each end of the primary winding of the transformer and having an auxiliary reactor, a first diode, and a snubber capacitor those are connected in series;

20 a fourth series circuit connected to each end of the auxiliary switch and having a second diode and the snubber capacitor those are connected in series; and

a control circuit to alternately turn on/off the main switch and auxiliary switch,

25 the snubber capacitor being charged when the main switch is turned on, and the snubber capacitor being discharged to the clamp capacitor when the main switch is turned off, to relax the inclination of a voltage increase of the main switch.

2. The switching power source apparatus of claim 1, wherein the control circuit turns on the auxiliary switch to 30 saturate a core of the transformer and increase an exciting

current, and then, turns off the auxiliary switch to make the main switch conduct zero-voltage switching.

3. The switching power source apparatus of claim 1 or 2,  
5 wherein the rectifying-smoothing circuit has a fifth series circuit having the secondary winding and a tertiary winding of the transformer, a sixth series circuit connected to each end of the fifth series circuit and having a first rectifying diode and a smoothing capacitor, and a second rectifying diode  
10 connected to a node between the secondary winding and the tertiary winding and a node between the first rectifying diode and the smoothing capacitor.

4. The switching power source apparatus of claim 3,  
15 wherein the primary and secondary windings of the transformer are wound around the core of the transformer so as to provide a leakage inductance, and the primary and tertiary windings of the transformer are wound so as to provide a leakage inductance that is smaller than the leakage inductance  
20 provided by the primary and secondary windings.

5. The switching power source apparatus of claim 4,  
wherein a magnetic path of the core of the transformer has a portion with reduced cross-sectional area.

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6. A switching power source apparatus comprising:  
a first series circuit connected to each end of a DC power source and having a primary winding of a transformer and a main switch those are connected in series;  
30 a rectifying-smoothing circuit to rectify and smooth a

voltage that is outputted from a secondary winding of the transformer when the main switch is turned off;

a second series circuit connected to each end of the main switch or to each end of the primary winding of the transformer and having an auxiliary switch and a clamp capacitor those are connected in series;

a third series circuit connected to each end of the primary winding of the transformer and having an auxiliary reactor, a first diode, and a snubber capacitor those are connected in series;

a fourth series circuit connected to each end of the auxiliary switch and having a second diode and the snubber capacitor those are connected in series; and

a control circuit to alternately turn on/off the main switch and auxiliary switch,

the snubber capacitor being charged when the main switch is turned on, the clamp capacitor being discharged through the secondary winding to the rectifying-smoothing circuit when the auxiliary switch is turned on, and the snubber capacitor being discharged to the clamp capacitor when the main switch is turned off, to relax the inclination of a voltage increase of the main switch.

7. The switching power source apparatus of claim 6, wherein the rectifying-smoothing circuit has a series circuit being connected to each end of the secondary winding of the transformer and having a rectifying diode and a smoothing capacitor.